

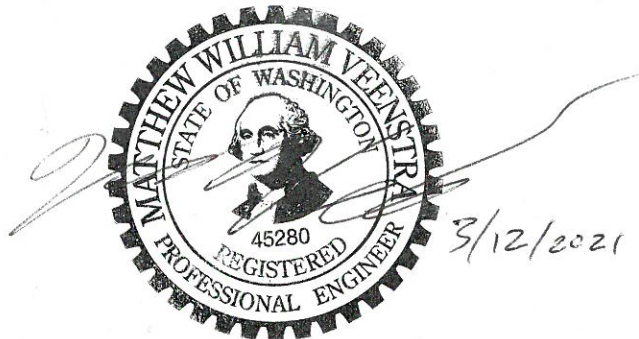
MEMORANDUM

DATE: March 12, 2021

TO: Mark Presleigh, Lease Crutcher Lewis

FROM: David Winter, PE and Matt Veenstra, PE

RE: **The Net**
Geotechnical Recommendations for Rubble Berm Support of Basement Walls
19567-01



This memorandum provides geotechnical recommendations for design and construction of temporary rubble berms (berms) to support existing basement walls during and after demolition of the existing building and basement interior structure.

We understand the demolition is scheduled to start in February 2021. Demolition will leave existing basement walls in place with concrete rubble placed against the basement walls to provide temporary support until the start of shoring for the future building excavation. The berms will support the existing basement walls along Third Avenue, Marion Street, Columbia Street, and the southern half of the alley on the south side of the site (Exhibit 2). Once shoring for the building begins the rubble berms will provide a working pad for construction equipment including equipment for installation of soldier piles and for tiebacks.

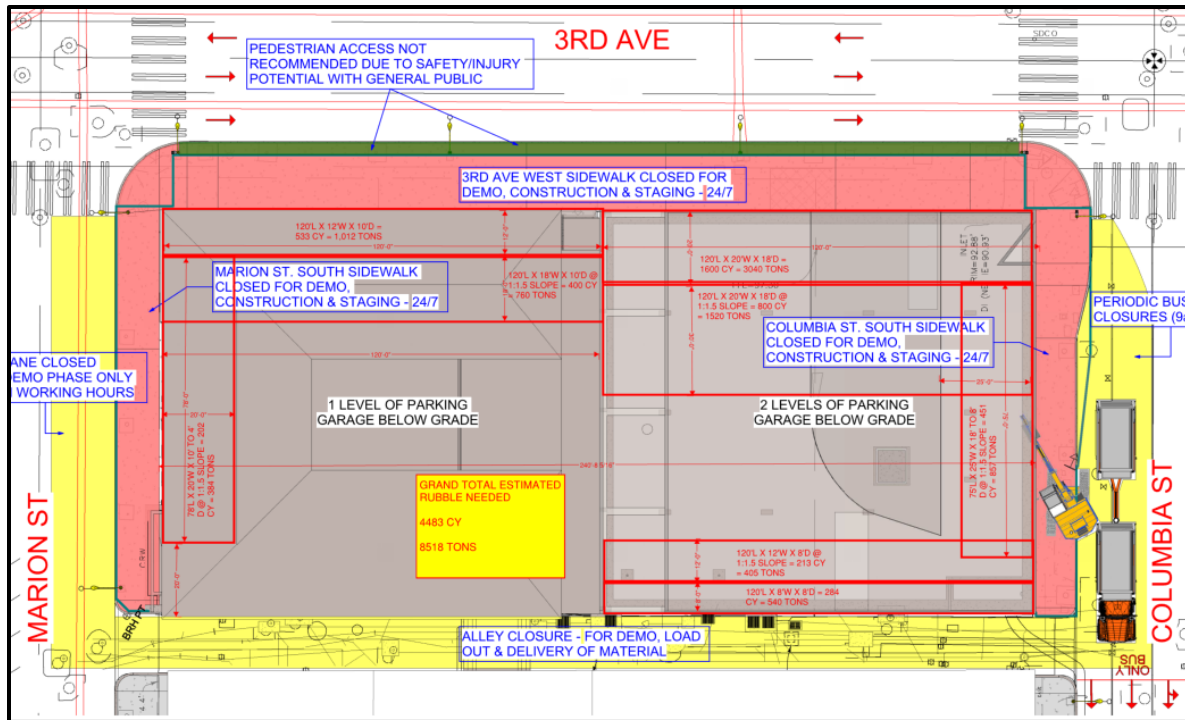


Exhibit 1 – Preliminary Rubble Berm Layout – Actual Layout Not Yet Determined

Crushed Concrete Rubble Berm Material

Based on correspondence with Lease Crutcher Lewis and RHINE we understand the concrete will be processed to approximately 12-inches-minus average size by excavator mounted hydraulic breakers and pulverizing attachments. The concrete rubble will not be further crushed or screened.

Construction of Rubble Berms

We understand that concrete slabs will be removed across most of the basement level except as needed to support and/or protect existing wall footings. Therefore, the berms may be placed on a combination of existing concrete slab and soil.

We assume that the rubble will be placed in nominal 18-inch-thick lifts and uniformly tamped or tracked into place using an excavator bucket (or similar).

RHINE plans to maintain the existing drainage during and after demolition so that surface water cannot pool within the excavation.



Berm Geometry

We assume a berm geometry like that shown in Exhibit 2. The fill slope is assumed to be no steeper than 1.5H:1V.

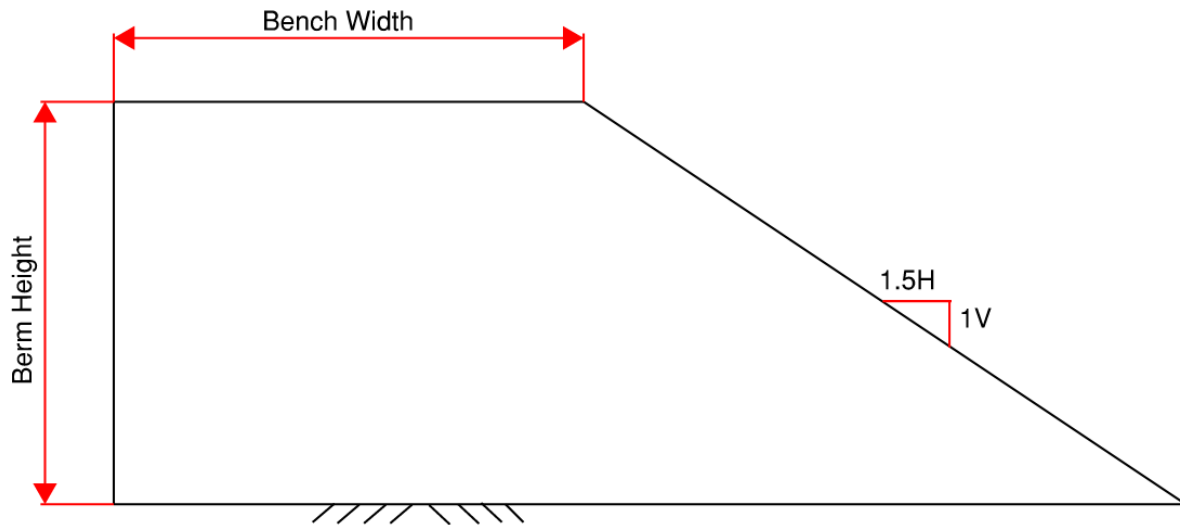


Exhibit 2 – Berm Geometry

Lateral Sliding Resistance

Lateral sliding of the existing walls is resisted by sliding friction beneath the existing wall foundation combined with the lateral resistance of the rubble berm. The total lateral resistance of the rubble berm is the **lesser of** the passive soil resistance of the berm or the base friction sliding resistance of the berm.

Base Sliding Friction of Existing Wall Foundation

For base sliding friction of the existing wall foundations, we recommend calculating the ultimate base friction sliding using an interface friction angle of 22 degrees (friction coefficient of 0.4). To calculate the sliding friction, the structural engineer will need to determine the normal reaction force against the bottom of the footing for the actual conditions at the time of demolition activities.

We recommend applying a factor of safety of 1.3 to calculate the allowable base friction sliding capacity of the existing wall foundation.



Base Friction Sliding of Rubble Berm

The lateral resistance of the rubble berm is the lesser of the allowable passive earth pressure and the allowable base friction sliding capacity of the berm.

For base sliding friction of the berm we recommend calculating the ultimate base friction sliding using an interface friction angle of 22 degrees (friction coefficient of 0.4). The weight of the berm should be calculated using a unit weight of rubble of 110 pcf.

We recommend applying a factor of safety of 1.3 to calculate the allowable base friction sliding capacity of the berm.

Passive Earth Pressure of Rubble Berm

Full passive earth pressure requires a wedge to form in front of the wall. To fully mobilize ultimate passive earth pressure the passive wedge extends in front of the wall a distance several times the height of the soil berm. Therefore, for a berm of practical width, the passive earth pressure will be reduced compared to a typical basement wall. Likewise, when soil slopes downward, away from the wall the passive earth pressure will be less than for the case of horizontal ground surface. Finally, full mobilization of passive earth pressure requires the wall to move into the soil approximately 0.01 to 0.04 times the height of soil in front of the wall. Because this amount of movement is typically not desirable, an allowable passive earth pressure factor of safety is used for design.

Table 1 provides passive earth pressure coefficients (k_p) for a range of potential berm geometries. The values in Table 1 are for a berm with a fill slope no steeper than 1.5H:1V.

An ultimate passive earth pressure equivalent fluid unit weight may be calculated by multiplying K_p by the assumed rubble material unit weight of 110 pcf. The recommended passive earth pressure distribution is triangular.

We recommend applying a minimum factor of safety of 2.0 to the ultimate passive earth pressure.



Table 1 – Passive Earth Pressure Coefficients

Berm Height (feet)	Bench Width (feet) ^a	Ultimate Kp
4	0	1.3
	4	5.7
8	0	1.3
	8	6.8
	12	8.0
12	0	1.3
	12	6.9
	18	7.9
18	0	1.3
	18	6.8

Notes:

- a. The passive pressure coefficients assume the berm slopes down at no steeper than 1.5H:1V

Limitations

We have prepared this memorandum for the exclusive use of Lease Crutcher Lewis and their authorized agents for The Net project in Seattle, Washington. Our work was completed in general accordance with our Services Agreement dated December 11, 2020. Our memorandum is intended to provide our opinion of geotechnical parameters for design and construction of the proposed project based on our understanding of the intended construction and existing site and subsurface conditions. However, conditions can vary from our understanding and assumptions and our conclusions should not be construed as a warranty or guarantee of site conditions or future site performance.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this memorandum was prepared. No warranty, express or implied, should be understood.

Any electronic form, facsimile, or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by Hart Crowser and will serve as the official document of record.

Gavin Klein

From: Veenstra, Matt <Matt.Veenstra@hartcrowser.com>
Sent: Friday, March 12, 2021 1:32 PM
To: Gavin Klein; Scott Neuman
Cc: Doug Maxfield; Mark Presleigh; Deanna Peters; Joel Simmonds
Subject: RE: 3rd and Columbia Demo - Active pressure on basement wall during rubble supported condition
Attachments: Final Geo report_The Net Rubble Berm Lateral Resistance_03-12-2020.pdf

[CAUTION: External Email]

Gavin,
I attached our stamped memo. There is no change except the date and the added stamp.
I talked to Scott and he is not planning to revise the KPFF submittal right now.

Regards,

Matt Veenstra, P.E. | Associate
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From: Gavin Klein <Gavin.Klein@lewisbuilds.com>
Sent: Friday, March 12, 2021 10:47 AM
To: Veenstra, Matt <Matt.Veenstra@hartcrowser.com>; Scott Neuman <Scott.Neuman@kpff.com>
Cc: Doug Maxfield <Doug.Maxfield@lewisbuilds.com>; Mark Presleigh <Mark.Presleigh@lewisbuilds.com>; Deanna Peters <deannap@rhinedemolition.com>; Joel Simmonds <joels@rhinedemolition.com>
Subject: RE: 3rd and Columbia Demo - Active pressure on basement wall during rubble supported condition

CAUTION: External Email

Hey Matt,

Following up our phone call, attached are KPFF's stamped drawings and calc package. As we discussed there will be two submittal packages, one for the 823 building and one for the 801 building.

Scott, talking with Matt the general notes in the drawings and calc package referencing the Geotech report might have to be revised as the report will have a new date (today). Please let me know if there is anything needed from Lewis.

Thanks,

Gavin Klein
Project Engineer

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